Fluidization of elongated particles - effect of multi-particle correlations for drag, lift and torque in CFD-DEM

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Abstract

Having proper correlations for hydrodynamic forces is essential for successful CFD-DEM simulations of a fluidized bed. For spherical particles in a fluidized bed, efficient correlations for predicting the drag force, including the crowding effect caused by surrounding particles, are already available and well tested. However for elongated particles, next to the drag force, the lift force and hydrodynamic torque also gain importance. In this work we apply recently developed multi-particle correlations for drag, lift and torque in CFD-DEM simulations of a fluidized bed with spherocylindrical particles of aspect ratio 4 and compare them to simulations with widely used single-particle correlations for elongated particles. Simulation results are compared with previous magnetic particle tracking (MPT) experimental results. We show that multi-particle correlations improve the prediction of particle orientation and vertical velocity. We also show the importance of including hydrodynamic torque.

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